Fall and Winter Roosting Ecology of Rafinesque's Big-Eared Bats (*Corynorhinus rafinesquii*) and Southeastern Bats (*Myotis austroriparius*)

PROJECT SUMMARY

Arkansas is home to two species of rare bats, Rafinesque's Big-eared bats (*Corynorhinus rafinesquii*) and Southeastern bats (*Myotis austroriparius*) listed as SGCN; S3. Little is known about these bats' roosting ecology in general, and even less during the fall and winter. Accordingly, we propose to use mist-netting, and acoustical monitoring techniques to characterize the activity of these bats during the winter and to equip captured individuals with radio transmitters in order to locate roost trees. Roost trees will be characterized and compared to random trees to determine roost tree selection patterns. The habitat surrounding roost trees will also be characterized and compared to random sites. Temperature and humidity data loggers (iButtons) will be placed inside roost trees and non-used cavity trees to characterize the microclimate of selected roost trees. Finally, data on flooding levels will be recorded in relation to basal cavity openings to determine if rising water levels trap bats inside trees and restricts their movements during winter months.

Project Leader:
Virginie Rolland, Ph.D.
Assistant Professor of Quantitative Ecology
Department of Biological Sciences
Arkansas State University
P.O. Box 599
State University, AR 72467
vrolland@astate.edu
phone: (870) 972-3194
fax: (870) 972-2638

Project Partner, Co-Principle Investigator:
Thomas S. Risch, Ph.D.
Professor & Chair
Department of Biological Sciences
Arkansas State University
P.O. Box 599
State University, AR 72467
trisch@astate.edu
phone: (870) 972-3333
fax: (870) 972-2638

Total Project Cost = $85,084
Total Arkansas SWG request = $55,300
Total Matching Funds* provided = $29,784 (35%)

*these are non-federal dollars supplied by Arkansas State University

Fall and Winter Roosting Ecology of Rafinesque's Big-Eared Bats (*Corynorhinus rafinesquii*) and Southeastern Bats (*Myotis austroriparius*)

Need – Bats are experiencing an overall population decline due to habitat alteration, wind turbines (800,000 bat fatalities per year; Smallwood, 2013), and White-Nose Syndrome (>5.7 millions deaths since 2006; U.S. Fish and Wildlife 2014b). Local extinctions of once common bat species may occur, and damages to the agricultural industry may reach billions of dollars a year (Frick et al. 2010, Boyles et al. 2011, USFWS 2012) given that species such as Rafinesque's big-eared Bats (*Corynorhinus rafinesquii,* CORA) primarily consume crop-damaging moths (Lacki et al. 2007). In addition to these catastrophic losses to agriculture are the unknown impacts on human health, as the diet of species of bats in decline such as Southeastern Bats (*Myotis austroriparius,* MYAU*)* mainly consists of mosquitoes (Zinn and Humphrey 1981), which are vectors of many human diseases (e.g., Rydell et al. 2002). Thus, conserving bat species is currently of paramount importance.

Arkansas' bottomland hardwood forests are the site of intensive habitat conversion (Tinner 1984, Hefner and Brown 1985) to farmland, resulting in few isolated pockets of wildlife habitat, causing a severely fragmented landscape. Fragmentation strongly affects wildlife population numbers and habitat use (Fahrig et al. 1983, Henderson et al. 1985). Under such environmental trends, it becomes urgent to study habitat use, such data being currently lacking for many species of bats, particularly CORA and MYAU, which both have been considered for listing as threatened in Arkansas (Bat Conservation International [BCI] and Southeastern Bat Diversity Network [SBDN] 2013).

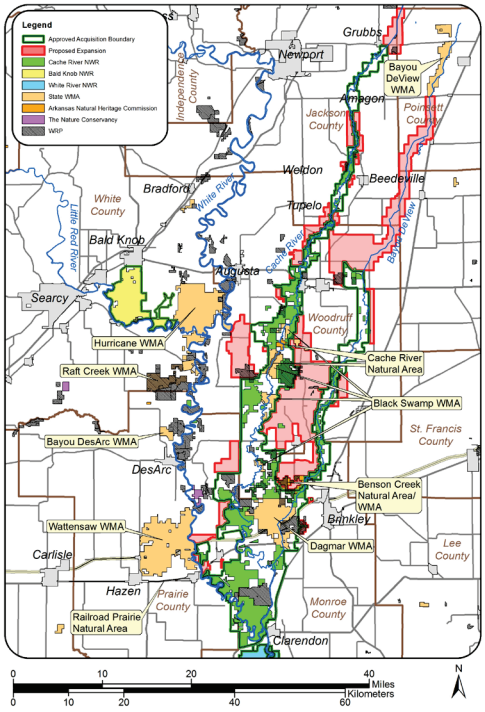
In 2004 our lab conducted a successful two-year study (funded by an AR SWG) to help fill in information gaps on the distribution and abundance of these two bottomland bat species. We documented 13 new county records for both CORA and MYAU from the Gulf Coastal Plain Mississippi Delta region of Arkansas (Fokidis et al. 2005, Medlin et al. 2006). During 2005, additional intensive sampling in selected locations in the Delta suggested that although typically present in bottomland fragments, the abundance of these species varies greatly among areas (Medlin and Risch 2008), likely because of a difference in the quality of available (particularly roosting) habitat. Importantly, however, little is known about the habitat use and requirements such as winter-roost sites, for these species of concern.

In response to the status of these species, BCI and SBDN have developed *A Conservation and Strategy for Rafinesque's Big-Eared Bats (*Corynorhinus rafinesquii*) and Southeastern Bats (*Myotis austroriparius*)* (BCI and SBDN 2013). This project delineates priority research needs which include winter roosting ecology of CORA and MYAU. Available data on summer roosts of CORA suggest they prefer large bottomland trees, particularly in the genera *Nyssa* and *Taxodium* (Lance et al. 2001, Johnson and Lacki 2011, Clement and Castleberry 2012). However, data on roost sites in AR are sparse and no published studies have data from late fall and winter. MYAU also seems to roost in large trees in bottomland hardwoods (BCI and SBDN 2013), but characteristics of winter roosts are lacking. In 2014, our lab located 12 summer roost trees: nine water tupelos (*Nyssa aquatica*), one red maple (*Acer rubrum),* one black gum (*Nyssa sylvatica*), and one sweet gum (*Liquidambar styraciflua*). Exit counts were conducted at roosts and some roosts contained over 400 bats. These roost trees were larger in diameter, in areas of higher canopy cover, and with a denser basal area than those at random sites. It is unknown if the same roost trees are used in the winter.

Priorities this proposal is addressing – This proposal directly addresses the need to study fall and winter roosting ecology of these species which is listed under mammals as Priority # 2 in the 2015 AR SWG RFP and is reflective of the lack of fall and winter data on these species throughout their respective range (BCI and SBDN 2013).

Purpose and Objectives – The overall goal is to increase our knowledge of the fall and winter roosting ecology of CORA and MYAU to address the research needs detailed by BCI and SBDN (2013). Our specific objectives are to:

1. Document fall and winter activity (e.g., emergence patterns, colony size) of CORA and MYAU.
2. Characterize roost trees used by CORA and MYAU during fall and winter compared to randomly selected trees.
3. Characterize habitat surrounding roosts and compare to randomly selected locations.
4. Characterize microclimate (temperature and humidity) of fall and winter roosts and non-used cavities for comparison.
5. Determine effects of winter flooding on CORA and MYAU.



1. – Location of Cache River NWR.

Location – The proposed study site is the Cache River National Wildlife Refuge, in Woodruff County just north of the Cache River Natural Area (Fig. 1) in a patch of mature bottomland hardwoods where we have already banded over 200 MYAU in 2014 for our ongoing (until September 2015) threatened and endangered (T&E) bat species inventory in the area. This ongoing study allows us to identify summer roost sites from which this proposed project can build.

Approach – Procedures specific to each objective are described below.

Approach Objective 1: Bats will be captured using mist nets in forest corridors or over water, and harp-traps (Fig. 2) at known summer roost trees during fall swarming and winter. Forty bats will be equipped with radio-transmitters to locate roost trees and describe activity throughout the winter (i.e., emergence and roost-switching patterns). At identified roost trees (GPS marked), we will assess colony size through exit counts and colony composition (to determine the extent to which both species roost in the same tree) using acoustic monitoring and harp-trapping.

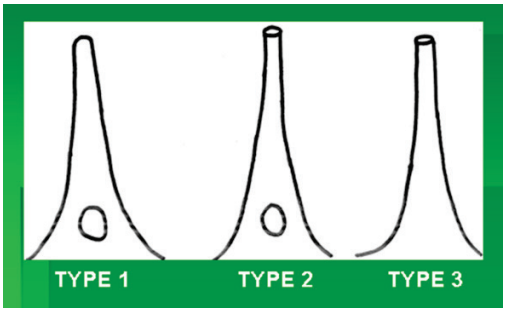
2. – Harp-trapping at the basal opening of a roost tree in the Cache River NWR

Approach Objective 2: For each identified roost tree, we will record tree data such as species, height, basal area, DBH, and type (Fig. 3), and cavity data (height and width). Trees selected randomly (to represent available trees) in a 50-m radius will be characterized using the same criteria.

Approach Objective 3: For each identified roost and associated random tree, the surrounding habitat will be characterized following BBIRD protocol. We will also compare winter vs. summer roost trees and plots

using data from our ongoing T&E bat inventory in the area to determine if CORA and MYAU use the same roosts year-round.

Approach Objective 4: We will place iButtons to record temperature and humidity in the cavity of roost trees and other available hollow trees (within each type [Fig. 3]) to characterize the microclimate of selected roost trees. If an unoccupied tree becomes occupied, the iButtons will capture a change in temperature.



3. – Classification of trees based on presence of basal cavity and chimney opening. © Chris Rice.

Approach Objective 5: We will measure the flood level at identified roost trees to determine if bats choose roost cavities in which they can become "trapped". For each captured individual, we will record forearm length and weight to obtain a fat ratio for fat loss comparison between flood-"trapped" vs. "untrapped" bats.

Expected Results and Benefits – Each objective will result in unique data that will allow managers to protect and conserve roost sites by tree preservation, cavity creation, and manipulation of hydrology. Additionally, determination of favorable roost trees at which winter counts can be conducted will improve estimate of population size. The Species of Greatest Conservation Need in AR that will benefit from this project are CORA and MYAU.

Budget	Justification	SWG	Match	Total
Personnel				
Project Leader (V. Rolland)	1.50 mo of Academic Salary		$9,600	$9,600
Graduate student	14 mo @1400/mo	$19,600		$19,600
Field Technician	6 mo @1300/mo	$7,800		$7,800
Fringes				
Project Leader (V. Rolland)	27.99%		$2,687	$2,687
Graduate student	1.89% of salary base	$370		$370
Undergraduate	9.44% of salary base	$736		$736
Supplies & Services				
2-way radios	2 @ 100	$200		$200
Headlamps	2 @ 90	$180		$180
TRX-1000s Receivers	2 @ 750	$1,500		$1,500
5-element Yagis	3 @ 150	$450		$450
Holohil LB-@X Transmitters	40 @ 200	$8,000		$8,000
iButton DS1923-F5#	30 @ 90	$2,700		$2,700
Publication cost		$1,500		$1,500
Travel				
Vehicle Mileage to study site	12,469@0.42/mile	$5,237		$5,700
Meetings		$2,000		$2,000
Total Direct Cost		**$50,273**	**$12,287**	**$63,023**
Indirect Cost	**10 % of TDC**	**$5,027**	**$ -------**	**$5,074**
Match Indirect Cost*	**36%- 10% SWF**	**$ ------**	**$13,074**	**$5,074**
Waived Indirect Cost	**49% of SWF**	**$ ------**	**$4,423**	**$4,423**
Total Cost		**$55,300**	**$29,784**	**$85,084**

Qualifications of the individual(s) and organizations(s) involved

Arkansas State University (A-State) is providing lab space, equipment (e.g., nets, Anabat acoustic detector), and assistance to this project within the College of Science and Mathematics. The research team's lab has studied Arkansas bats for over 12 years. Our ongoing study with MYAU and CORA with Cache River National Wildlife Refuge allows us access to study populations and housing in close proximity to marked populations and known summer roost trees, in effect starting this project within weeks of the conclusion of our current study.

Dr. Virginie Rolland has a Ph.D. in Population Ecology from University Pierre et Marie Curie (Paris, France). She is an Assistant Professor of Quantitative Wildlife Ecology. Rolland's strength is in quantitative analyses of wildlife data. She has started studying bat roosting and foraging ecology two years ago, supervising two graduate students (one who studies foraging habits of female gray bats, and another who defended his thesis this month on sexual segregation in evening bats in the Sylamore District), and co-mentoring a third graduate student focusing on CORA and MYAU summer roosting ecology in the Cache River NWR.

Dr. Thomas Risch is a bat expert with a Ph.D. from Auburn University. He is a Professor of Animal Ecology, Curator of Mammals, and Chair of the Department of Biological Sciences at A-State. Risch's strength is in field ecology with over 12 years of experience studying bats in the Eastern United States. He served on the technical advisor group that produced *A Conservation and Strategy for Rafinesque's Big-Eared Bats (*Corynorhinus rafinesquii*) and Southeastern Bats (*Myotis austroriparius*)*. He has served on the Board of Directors of the Southeastern Bat Diversity and is on this group's White-Nose Syndrome committee. He, along with students, has published 17 peer-reviewed papers on bats including four that focus on the species addressed in this proposal. He will provide expertise, materials and assistance from the field ecology lab at A-State.